New method used to research mollusks, cavefish

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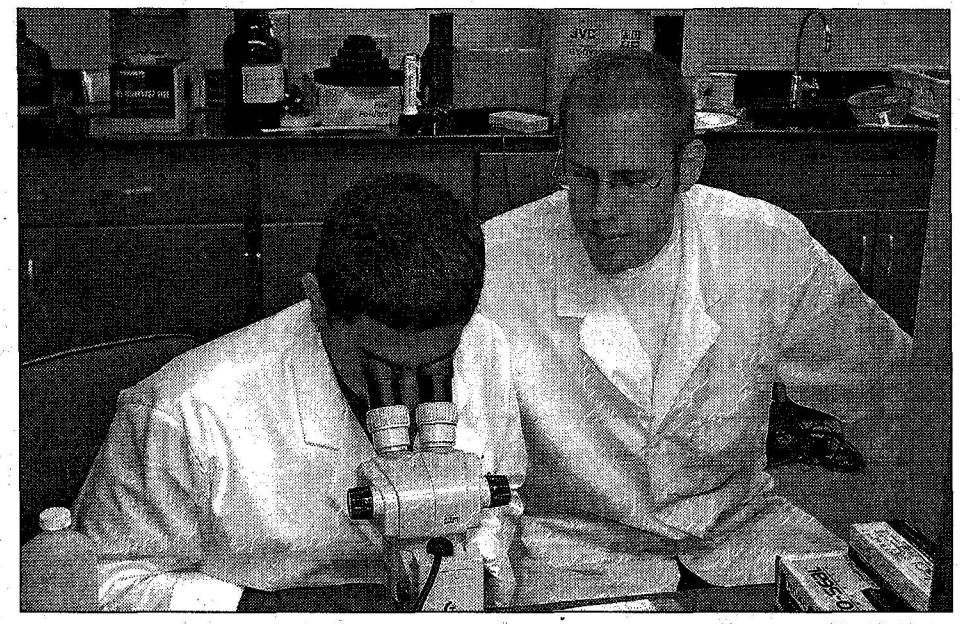
SPECIAL FOR THE SUN



Aldemaro Romero I Special to The Sun

Kapil Mandrekar and David Hayes analyze cave fish specimens at an Arkansas State University lab in this undated photo.

Many people see biologists either working in the field dealing with wild fauna and flora, or in their labs working with DNA. However, in the last few years a new technique that combines mathematics and morphological studies is helping scientists better understand the shape of nature.

This new technique is called geometric morphometrics. Morphometrics consists of making measurements of animals and plants in order to quantify the shapes of living organisms. Geometric morphometrics involves removing size as a confounding factor.

The idea is to get a mathematical account for the shapes of organisms so we can better understand how they adapt to different environments.

The reasoning behind this approach is that biologists have known for centuries that the form of a creature is related to its function. By getting a measurement of the shapes of living organisms, they can tell how they adapt to different environments.

For example, we know that animals living in cold environments tend to be bulky in order to reduce the area of their body in comparison to their body mass. That is a way to reduce heat loss in low temperatures. Biologists call that generalization "Bergman's rule" after the German scientist Carl Bergman who first proposed it in 1847.

To do these measurements scientists use what are called "landmarks" or points on the organism, measure the distances and angles between those points, and then use statistical methods to analyze the results of their measurements.

At Arkansas State University two groups of organisms are being studied using morphometrics: mollusks and cave fish. Hayes and researchers from Duke University and University of Louisiana at Monroe, are using morphometrics of shells and examination of snail DNA to study snails found in springs across Texas.

The snails are found in freshwater springs, which don't have any connections, and so it was expected that the snails in the springs would show the results of long-term isolation from each other or a lack of interbreeding.

Instead, what we found was very little difference in either the shape or genetics of snails from isolated springs. This lack of difference was surprising.

How do snails cross hundreds of miles of inhospitable habitat? We concluded it was most likely that snails have

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been hitchhiking between springs in Texas along with human movements of the mosquito fish, which has been stocked across Texas for mosquito control.

Romero and Mandrekar are using morphometics to analyze how the isolation affects the shapes of the fish. To that end we are studying the North American cavefish family, Amblyopsidae, found in the south and southeastern United States, including Arkansas, to know if shape differs between different populations of the same species as well as how each species differs from one another. Understanding how the environment the fish lives in affects its shape and understanding the life history of fish help to better conserve these populations.

Different shapes could provide clues about how different fishes adapted to different environments. For example, species or populations that slip through smaller crevices of the subterranean environment would have slender bodies. So far, we have found clear differences among different populations.

Thus, studying the "geometry of life" we can better understand a key biological phenomenon: adaptation, and what we need to do to preserve the rich biological diversity we find on earth.

Dr. Romero is chairman and professor at the Department of Biological Sciences at Arkansas State University. Hayes is a doctoral student in the environmental sciences program at ASU, and Mandrekar is an undergraduate student in the RISE program at ASU. For more information about the Department of Biological Sciences e-mail biology@astate.edu.